

CUBIC CORPORATION

CUBIC INCREMENTAL/CONTINUOUS MAGNETIC TAPE SYSTEM

Model TH-3700

The Cubic Incremental/Continuous Magnetic Tape System (ICMTS) consists of an incremental tape unit and associated control and buffer logic. The unit is capable of accepting (and, in many cases, of accepting and stacking) thirteen different commands. In addition it outputs 10 different signals to indicate its status. Thus the ICMTS is designed to operate with computers in a relatively program free manner while writing and reading IBM compatible tapes.

The ICMTS is militarized and has passed rugged environmental testing. The dimensions are 23" x 10" x 19.75". The unit weighs 105 pounds and draws 260 watts of AC power.

The Cubic ICMTS writes 200 BPI binary tapes incrementally at any rate up to 300 characters per second. The unit can be simply and easily converted to write and read BCD tapes by moving three plug-in wires. Upon command (write pulse) from the computer, the ICMTS samples the input data lines, writes the data on tape and performs a write echo parity check on each character as it is written and a read after write check to ascertain that data is being written on the tape as it steps .005 of an inch. Completion of the operation is signalled to the computer with a Character Write Complete signal. Depending upon the status of the Parity Inhibit command from the associated computer, the unit will generate correct vertical parity for each character to be written or it will accept a seven bit character from the computer.

Upon receipt of a Write EOR command from the computer, the unit generates an EOR gap including the Longitudinal Redundancy Check Character. When the operation is completed, a signal (Tape Unit Write Ready) is sent to the computer. The EOR gap is generated at 30 inches per second as is the EOF gap.

Forward read and forward search are done at 30 IPS by the forward motor capstan and its associates pinch roller. While reading forward every character is checked for correct vertical parity and every record is checked for correct

longitudinal redundancy. All data characters are outputted to the associated computer. The Tape Clock pulse indicates to the computer the presence of a new character on the Output Data Lines. EOF characters and LRC characters are not outputted to the computer. When an EOF is read, a signal is generated on the EOF line to the computer and when an EOR is detected, a signal is sent to the computer on the EOR line.

Backward search, used in backspacing records, in backspacing file, and in automatically positioning tape for writing, is accomplished at 30 IPS by the backward motor capstan and its associated pinch roller.

Rewind is done at high speed with a reel of 2500 feet of tape being rewound in three minutes. At the conclusion of a rewind, the tape is automatically positioned to facilitate reading the first record and a Tape Unit Read Ready signal is sent to the computer.

In addition to the error checking circuits which monitor the data while reading and writing, the ICMTS also will detect tape spillage, tape breaking, and tape jamming and generate a Tape Malfunction signal whenever any of these occur.

Tapes can be replaced easily with no need to remove power from the ICMTS. The power supplies are short circuit protected and contain no fuses. Even in the event of a failure in a power supply or a short circuit, a contact closure is made to automatically signal the computer of such an occurrence.

The two main features which made the ICMTS so program free are as follows:

1. Whenever the computer issues a command to the ICMTS, its responsibility is finished. The system logic will execute the command and signal the computer upon completion.
2. The ICMTS is capable of stacking commands in several cases. For instance, the computer could issue the following sequence to the ICMTS-Forward, Backspace Record, and Rewind. The system logic would accept all three, execute them in that sequence and signal the computer when the sequence had been completed.

Truly an automatic versatile magnetic tape system.

CUBIC INCREMENTAL/CONTINUOUS MAGNETIC TAPE SYSTEM
COMMAND LISTING

FORWARD

The receipt of a Fwd command shall cause the tape unit to read forward until a BR, BF, Stop, Rewind, or Reset command is received or until more than 8 ± 3 inches of blank tape is detected. If blank tape is detected, the tape unit shall position the tape beyond the last recorded data on the tape at a location which will enable the writing of a new record. If there is no data on the tape, the tape will be positioned 2.4 inches from Load Point. A.T.U. Wr Ready pulse shall be issued at the conclusion of the operation.

COMMAND SEQUENCE

ACTION

Forward-Forward

2nd FWD shall be ignored unless it occurs after the Tape Unit Write Ready pulse is issued, in which case the 2nd FWD will be executed.

Forward-Stop

Will cause the tape to stop in the first End of Record gap detected after receipt of the Stop command. The Stop command must be issued within 5 milliseconds after detection of the EOR. If not, the tape unit will continue to the next EOR gap and then stop.

Forward-Backspace Record

Action will depend upon when Backspace-Record command is received. See Backspace Record. Must be issued within 5 milliseconds after detection of the EOR gap. If not, the tape unit will continue to the next EOR gap and then execute the BR. If the BR occurs after the T.U.W. Ready pulse is issued, the BR shall be executed.

Forward-Backspace File

The BF must be issued within 5 milliseconds after detection of the EOR gap. If not, the tape unit will continue to the next EOR gap and then execute the BF.

COMMAND SEQUENCEACTION**Forward-Backspace File**

If the BF occurs after the Tape Unit Write Ready pulse is issued, the BF shall be executed.

Forward-Rewind

Will cause tape to stop in first EOR gap detected after receipt of Rewind command and rewind to Load Point.

If the Rewind occurs after the Tape Unit Write Ready pulse is issued, the Rewind shall be executed.

Forward-Reset

Will cause an immediate unconditional stop..

Forward-Position Tape Write

The P. T. W. shall be executed whenever it is received.

Forward-Position Tape Read

The P. T. R. shall be ignored if no Reset has been issued since the initial P. T. R. was issued. If a reset has occurred since the initial P. T. R., tape shall move forward until a Stop or Reset is received.

STOP

The receipt of a Stop command while reading forward shall cause the tape to stop in the first EOR gap detected after receipt of the command provided the command is received within 5 milliseconds after EOR detection. If it is not issued within 5 milliseconds after EOR detection, the tape shall stop in next succeeding EOR gap.

COMMAND SEQUENCESACTION**Stop-Stop**

Redundant STOP will be ignored.

Stop-Backspace Record

When the Backspace Record command is received after completion of the Stop operation, the Backspace Record will be executed as described under Backspace Record.

If BR is received before completion of the Stop operation, the Stop shall be ignored or overridden.

COMMAND SEQUENCEACTION**Stop-Backspace File**

When the Backspace File command is received after completion of the Stop operation, the Backspace File will be executed as described under Backspace File.

If BF is received before completion of the Stop Operation, the Stop shall be ignored or overridden.

Stop-Reset

Will cause an immediate, unconditional Stop if Stop operation is not completed before receipt of the Reset command.

Stop-Rewind

When the Rewind command is received after completion of the Stop operation, the Rewind will be executed as described under Rewind. If Rewind is received before completion of the Stop operation, the Stop shall be ignored or overridden.

Stop-Position Tape Write

When the Position Tape Write command is received after completion of the Stop operation, the Position Tape Write command will be executed as described under P. T. W.

BACKSPACE RECORD

The receipt of a Backspace Record command while reading forward within a record shall cause the tape to backspace two records or to Load Point, whichever occurs first, and then read forward; i. e., when the Backspace Record command is received at least 20 microseconds prior to the detection of the EOR gap for the record being read. When the Backspace Record command occurs while stopped in EOR gap, or when it occurs within 5 milliseconds after detection of an EOR gap, the tape shall backspace one record or to load point whichever occurs first, and then read forward. If the BR is received 5 milliseconds or more after EOR detection, the tape will continue forward until the next EOR gap is detected before performing the BR operation.

COMMAND SEQUENCESACTION**Backspace Record-Stop**

When the Stop command is received after completion of backward motion, the tape will stop in the first EOR gap detected after receipt of the Stop. The stop shall be ignored if the stop command is received after receipt of BR and prior to completion of the backward motion portion of the BR operation.

Backspace Record-Backspace Record

The second Backspace Record will be ignored unless the tape has completed backward motion, the Backspace File will be executed as described under Backspace File. If the BF is received before completion of the backward motion portion of BR, the BF shall be executed.

Backspace Record-Rewind

Will cause the tape to rewind to Load Point after the BR has been completed.

Backspace Record-Reset

Will cause an immediate, unconditioned Stop.

**Backspace Record-Position
Tape Read**

The P. T. R. shall be ignored if no Reset has been issued since the initial P. T. R. was issued.

BACKSPACE FILE

The receipt of a Backspace File, when stopped in an EOR gap shall cause the tape to backspace past two EOF marks or to Load Point, whichever occurs first, and then read forward. The receipt of a Backspace File command while reading forward shall cause the tape to stop in the first EOR gap detected after receipt of the command before backspacing past two EOF marks or to Load Point, whichever occurs first, and then read forward. If Backspace File is received 5 milliseconds or more after EOR detection, the tape unit shall continue forward to the next EOR gap before performing the backspace file operation and then backspace two EOF marks or to load point whichever occurs first and then read forward.

COMMAND SEQUENCESACTION**Backspace File-Stop**

When the Stop command is received after completion of backward motion, the tape will stop in the first EOR gap detected after receipt of the Stop. The Stop shall be ignored if the Stop command is received before the completion of the backward motion portion of the BF operation.

COMMAND SEQUENCESACTION

Backspace File-Backspace File

The second Backspace File will be ignored unless the tape has completed backward motion before it is issued in which case it will be executed as described above.

Backspace File-Backspace
Record

When the Backspace Record command is received after completion of backward motion, the Backspace Record will be executed as described in Backspace Record.

If the BR is received at least one record prior to the detection of the 2nd EOF during the backward motion, the BR shall be ignored. If received after detection of the last record prior to the detection of the 2nd EOF during the backward motion, the tape unit shall either backspace over the 2nd EOF before reading forward or over the 2nd EOF plus one more record before reading forward.

Backspace File-Rewind

Will cause the tape to rewind to Load Point after completion of the BF operation.

Backspace File-Reset

Will cause an immediate, unconditional stop.

Backspace File-Position Tape
Read

P.T.R. shall be ignored if no Reset has been issued since the initial PTR was issued.

WRITE PULSE

A Write Pulse shall be issued to the tape unit only when Write Control Gate has been up for at least 30 microseconds and remains up at least until Char. Wr. Complete is issued. The receipt of a Write Pulse shall cause the tape unit to sample the six or seven output data tracklines (depending on whether Parity Inhibit is at -8 or +8 VDC respectively), write a character on tape, advance the tape to the next writing position, and issue a Character Write Complete signal on the Tape Clock line at the conclusion of the operation. The data lines must be stable at least nine microseconds prior to the receipt of the Write Pulse and remain stable until the end of the Write Pulse.

COMMAND SEQUENCESACTION

Write Pulse-Write Pulse

Cannot be issued until DSSS signals Character Write Complete. Write Control Gate must be left up.

Write Pulse-Write EOR

Cannot be issued until DSSS signals Character Write Complete. Write Control Gate must be left up.

Write Pulse-Stop

Will be ignored.

WRITE EOR

The receipt of a write EOR command shall cause the tape to move 0.023 ± 0.005 inches, write the longitudinal check character, move $3/4 + 5/32$, $-1/16$ inches, and issue a tape unit Write Ready pulse upon completion of the Write EOR operation. Write control gate must be up at least 30 microseconds prior to the receipt of the Write EOR command and stay up at least until the tape unit Write Ready pulse is issued.

COMMAND SEQUENCESACTION

Write EOR-Rewind

Cannot be issued until the Tape Unit Write Ready Pulse is issued and Write Control Gate is dropped. Will cause tape to rewind to Load Point.

Write EOR-Backspace Record

Cannot be issued until the Tape Unit Write Ready Pulse is issued and Write Control Gate is dropped. The Backspace Record will be executed as described under BACKSPACE RECORD.

Write EOR-Forward

Cannot be issued until the Tape Unit Write Ready Pulse is issued and Write Control Gate is dropped. The Forward will be executed as described under FORWARD.

Write EOR-Position Tape Write

Cannot be issued until the Tape Unit Write Ready Pulse is issued and Write Control Gate is dropped. The Position Tape Write will be executed as described under POSITION TAPE WRITE.

COMMAND SEQUENCESACTION

Write EOR-Write Control Gate

Will condition the tape unit to write.

Write EOR-Parity Inhibit

Will condition the tape unit to duplicate.

Write EOR-Write Pulse

Cannot be issued until the Tape Unit Write Ready Pulse is issued. Write Control Gate must be left up. The Write Pulse will be executed as described under WRITE PULSE.

Write EOR-Write EOF

Cannot be issued until the Tape Unit Write Ready Pulse is issued. Write Control Gate must be left up. The Write EOF will be executed as described under WRITE EOF.

Write EOR-Position Tape
Read

The PTR shall be ignored if no Reset has been issued since the initial PTR was issued. If a reset has occurred since the initial PTR, the tape shall move forward until a Stop or Reset is received.

Write EOR-Stop

Will be ignored.

Write EOR-Backspace File

Cannot be issued until the Tape Unit Write Ready Pulse is issued and Write Control Gate is dropped. Backspace File shall be executed as described under BACKSPACE FILE.

WRITE EOF

The receipt of a Write EOF command shall cause the tape unit to generate an EOF gap before writing an EOF mark and its associated Longitudinal Redundancy Check character and then generating an EOR gap. A Tape Unit Write Ready Pulse shall be issued at the conclusion of the operation. Write Control Gate must be up at least 30 microseconds prior to the receipt of the Write EOF command and stay up at least until the Tape Unit Write Ready pulse is issued.

COMMAND SEQUENCESACTION

Write EOF-Rewind

Cannot be issued until the Tape Unit Write Ready Pulse is issued and Write Control Gate is dropped. Will cause tape to rewind to Load Point.

COMMAND SEQUENCESACTION

Write EOF-Forward

Cannot be issued until the Tape Unit Write Ready Pulse is issued and Write Control Gate is dropped. The Forward will be executed as described in FORWARD.

Write EOF-Backspace Record

Cannot be issued until the Tape Unit Write Ready Pulse is issued and Write Control Gate is dropped. The Backspace Record will be executed as described in BACKSPACE RECORD.

Write EOF-Position Tape Write

Cannot be issued until the Tape Unit Write Ready Pulse is issued and Write Control Gate is dropped. The Position Tape Write will be executed as described in PTW.

Write EOF-Write Control Gate

Will condition the tape unit to write data.

Write EOF-Parity Inhibit

Will condition the tape unit to duplicate tape.

Write EOF-Write Pulse

Cannot be issued until the Tape Unit Write Ready Pulse is issued. Write Control Gate must be left up. The Write Pulse will be executed as described under WRITE PULSE.

Write EOF-Write EOF

Cannot be issued until the Tape Unit Write Ready Pulse is issued. Write Control Gate must be left up. The Write EOF will be executed as described under WRITE EOF.

Write EOF-Position Tape
Read

The PTR shall be ignored if no Reset has been issued since the initial PTR was issued. If a reset has occurred since the initial PTR, the tape shall move forward until a Stop or Reset is received.

Write EOF-Stop

Ignored.

Write EOF-Backspace File

Cannot be issued until TUWR pulse is issued and WCG is dropped. The BF will be executed as described under BACKSPACE FILE.

WRITE CONTROL GATE

The receipt of a Write Control Gate shall condition the tape unit to write. It must be up at least 30 microseconds before every Write Pulse of a record and stay up at least until the Character Write Complete Pulse is issued. It also must be up at least 30 microseconds before a Write EOR or a Write EOF are issued and stay up at least until the tape unit Write Ready pulse is issued.

COMMAND SEQUENCESACTION

Write Control Gate-Write Pulse	See WRITE PULSE.
Write Control Gate-Write EOF	See WRITE EOF.
Write Control Gate-Stop	Will be ignored.
Write Control Gate-Parity Inhibit	Will condition the tape unit for duplication.
Write Control Gate-Write Control Gate	Will condition the tape unit for writing.
Write Control Gate-Reset	See RESET.
Write Control Gate-Write End of Record	See WRITE END OF RECORD.

PARITY INHIBIT

The receipt of Parity Inhibit shall condition the tape unit to duplicate data from the SSMS instead of generating parity for each character. It must be up at least 30 microseconds before every Write Pulse is received and stay at least until the Character Write Complete is issued.

COMMAND SEQUENCESACTION

Parity Inhibit-Stop	Will be ignored.
Parity Inhibit-Write Pulse	See WRITE PULSE.
Parity Inhibit-Write EOR	See WRITE END OF RECORD
Parity Inhibit-Write EOF	See WRITE END OF FILE
Parity Inhibit-Write Control Gate	See WRITE CONTROL GATE
Parity Inhibit-Parity Inhibit	See PARITY INHIBIT
Parity Inhibit-Reset	See RESET.
Parity Inhibit-PTR	See FWD-PTR.

POSITION TAPE WRITE

The receipt of a Position Tape Write command will cause the tape unit to position the tape beyond the last recorded data on the tape at a location which will enable the writing of a new record. If there is no data on the tape, the tape will be positioned 2.4 inches from Load Point. A Tape Unit Write Ready Pulse will be issued at the completion of the operation. The issuance of tape data output shall be inhibited during the execution of the Position Tape Write operation whether the operation was initiated by the SSMS or initiated internal to the tape unit.

COMMAND SEQUENCESACTION

Position Tape Write-Forward	When the Forward command is received after completion of the Position Tape Write operation, the Forward command will be executed under FORWARD.
Position Tape Write-Stop	Will cause an immediate, unconditional stop if internal stop and backspace has not been issued.
Position Tape Write-Backspace Record	If the Backspace Record command is received after completion of the Position Tape Write operation, the Backspace Record command will be executed. See Backspace Record.
Position Tape Write-Backspace File	If the Backspace File command is received after completion of the Position Tape Write operation, the Backspace File command will be executed. See BACKSPACE FILE.
Position Tape Write-Parity Inhibit	Will condition the tape to duplicate.
Position Tape Write-Rewind	When issued after completion of the Position Tape Write operation, the Rewind will be executed as described under REWIND.
Position Tape Write-Reset	Will cause an immediate, unconditional stop.
Position Tape Write-Position Tape Read	PTR shall be ignored if no Reset has been issued since the initial PTR was issued.

POSITION TAPE READ

The receipt of a Position Tape Read shall cause the tape to move forward to Load Point in position to read the first record on the tape. A Tape Unit Read Ready Pulse shall be issued at the conclusion of the operation. If PTR is accepted after tape has passed load point the tape will move forward until a stop or reset command is received.

COMMAND SEQUENCESACTION

Position Tape Read-Forward

When the Forward command is received after completion of the Position Tape Read operation, the Forward will be executed as described under Forward.

Position Tape Read-Stop

Will cause an immediate, unconditional stop.

Position Tape Read-Position
Tape Write

When the Position Tape Write command is received after completion of the Position Tape Read operation, the Position Tape Write command will be executed. See Position Tape Write.

Position Tape Read-Position
Tape Read

Will be ignored.

Position Tape Read-Rewind

If the Rewind command is received after completion of the Position Tape Read operation, the Rewind Command will be executed. See Rewind.

Position Tape Read-Reset

Will cause an immediate, unconditional stop.

Position Tape Read-Backspace
Record

If the Backspace Record command is received after completion of the Position Tape Read operation, the Backspace Record command will be executed. See Backspace Record.

Position Tape Read-Backspace
File

If the Backspace File command is received after completion of the Position Tape Read operation, the Backspace File command will be executed. See Backspace File.

Position Tape Read-Parity
Inhibit

Acceptable but restricted to the conditions as defined in the Parity Inhibit list.

REWIND

The receipt of a Rewind Command shall cause the tape to rewind to Load Point and then move forward and stop in position to read the first record on the tape. A Tape Unit Read Ready Pulse shall be issued at the completion of the operation.

COMMAND SEQUENCESACTION

Rewind-Rewind	The second Rewind will be ignored unless the first Rewind has been completed in which case it will be executed.
Rewind-Forward	When the Forward command is received after completion of the Rewind operation, the Forward will be executed as described under FORWARD.
Rewind-Backspace Record	When the Backspace Record command is received after completion of the Rewind operation, the Backspace Record will be executed as described under BACKSPACE RECORD.
Rewind-Backspace File	When the Backspace File command is received after completion of the Rewind operation, the Backspace File will be executed as under BF.
Rewind-Position Tape Write	When the Position Tape Write command is received after completion of the Rewind operation, the Position Tape Write will be executed as under PTW.
Rewind-Position Tape Read	PTR shall be ignored if no Reset has been issued since the initial PTR was issued.
Rewind-STOP	Will be ignored.

RESET

The receipt of a Reset shall cause all the control, output, and data flip flops to be turned off. No other commands should be issued to the DSSS during the ten to twenty millisecond Reset interval and until at least thirty microseconds after the end of the Reset pulse.

COMMAND SEQUENCESACTION

Reset-Forward

See Forward.

Reset-Stop

Will be ignored.

Reset-Backspace Record

See BACKSPACE RECORD.

Reset-Backspace File

See BACKSPACE FILE.

Reset-Position Tape Write

See Position Tape Write.

Reset-Position Tape Read

See Position Tape Read.

Reset-Rewind

See Rewind.

Reset-Reset

See RESET.

ELECTRICAL SPECIFICATIONS

1. Power Source: Three phase, 115 VAC line to line
2. Power Requirements: 325 VA
3. Logic Levels:
 - a. At input: 8 VDC = "1", -8 VDC = "0"
 - b. Internally: Ground = "1", +8 VDC "0"
4. Acceptable Input Commands:
 - a. Read
 - b. Write
 - c. Write EOR
 - d. Write EOF
 - e. Rewind
 - f. Parity Inhibit
 - g. Backspace
 - (1) File
 - (2) Record
 - h. Search
 - (1) Blank Tape
 - (2) Load Point
5. System Status Responses
 - a. Tape Motion Stopped
 - b. Ready to Read (Load Point Detector)
 - c. Ready to Write (Blank Tape Detector)
 - d. Tape Malfunction Detected
 - e. EOR Detected (EOR - end of record)
 - f. EOF Detected (EOF ² end of file)
 - g. Parity Error Detected
 - h. EOT Detected (EOT - end of tape)
 - i. Character Ready (Character Write Complete)
 - j. Power Failure

DATA

1. Input Register - 7 bits
2. Output Register - 7 bits
3. Incremental Rate - in excess of 300 steps per second
4. Binary or BCD

5. IBM Compatible
 - a. 200 bpi Recording Density
 - b. Character by Character Echo Check
 - c. Character by Character Vertical Parity Check
 - d. Longitudinal Parity Check Per Each Record
 - e. 30 ips Read
6. Discretionary Parity Generation (7 output lines)
 - a. 6 Bits Data and 1 Bit Parity, or;
 - b. 7 Bits Data

PHYSICAL CHARACTERISTICS

1. Rack Mounted
2. Solid State
 - a. PC Microcircuit Logic
 - b. Amplifiers
 - c. Drivers
3. Size
 - a. Height - 10"
 - b. Depth - 23"
 - c. Width - 16-3/4"
4. Weight - 110 pounds